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FUTURE INTERNET
TESTING FACILITY

A digital resources warehouse as a playground for the future Internet

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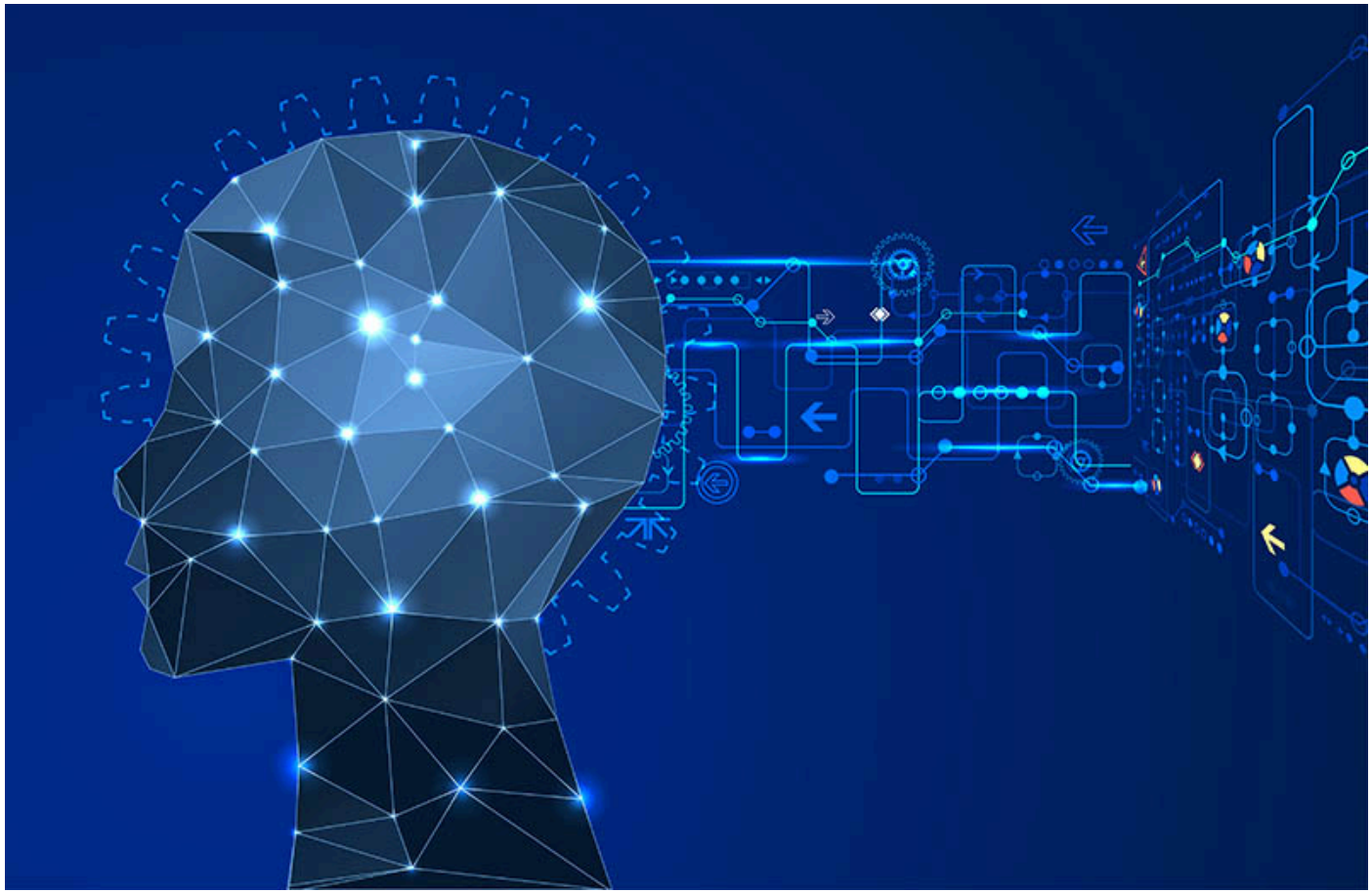
Inauguration R2Lab, 9 novembre 2016

Digital transformation



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Scientific instrument as a support for discovery

- Complex systems (of systems)
- Largely distributed
- Partially managed

- Robust
- Efficient
- Manageable

- A Community approach
  - « *Public good* »

- See Caida: Center for Appled Data Internet Analysis
http://www.caida.org/

Design objectives & selling points

- Deploy a large set of digital resources from sensors to data centers
- Open, remotely accessible, virtualized infrastructure

- Mobilize the scientific community in the domain of digital sciences
- Provide rich, diverse and advanced tools: test, measurement, benchmarking, reproducibility, data repository, …

- Articulate the french and European efforts in this domain
- International attarcativity and visibility (unique today at the international level)

- Typically a mid-scale infrastructure

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Scientific challenges

- Design cloud-IoT converged infrastructures
  - Scaling factor
  - Hexascale platform
  - Programmable and agile (SDN/NFV, 5G)
- Maneagability of these systems
  - Agility
  - Self-ability
  - Global orchestration
- Managing Complexity
  - Resources
  - Energy
- Mastering data flows
  - Data deluge management

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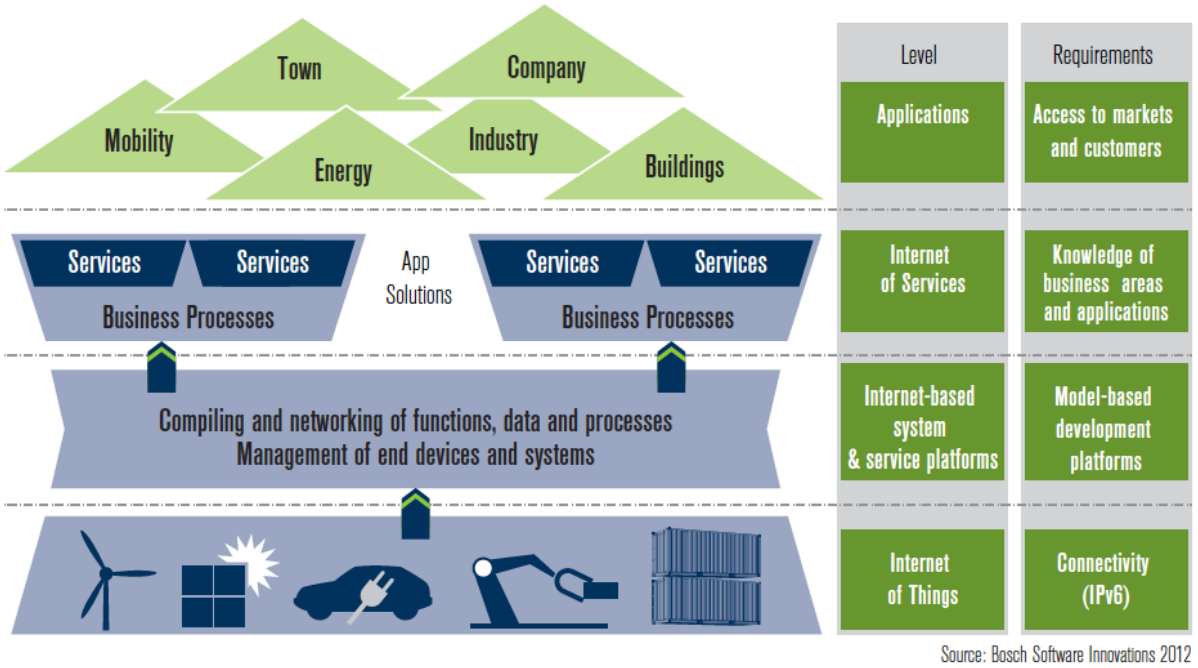
Application domains and exploitation

- See the verticals in all domains
- Health, Industry, Transport, Energy, Environment, Smart Cities, …



Source: Bosch Software Innovations 2012

FIT Equipex (PIA1) Consortium

ANR

UPMC
SORBONNE UNIVERSITÉS

Inria
INVENTORS FOR THE DIGITAL WORLD

UNIVERSITÉ DE STRASBOURG

MINES TELECOM
INSTITUT
Mines-Télécom

cnrs
dépasser les frontières

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Status of the equipments

• **Test Infrastructure open for Internet systems** (TIC) & their applications (vertical)
• **Remote access** (gouvernance, portail FIT, software mgt tools)
•**3 key technologies & open NOC**

- **FIT Wireless** (WiFi, cognitive radio)
- **FIT IoT-Lab** (Sensors, mobile robots, radio, LED)
- **FIT Cloud** (Bare metal, SDN, VM)
- ***Network Operations Center*** *(incluant un accès à PLE)*

•**Nationaly dustributed on 9 sites**
•Paris (2), Evry, Saclay, Lille, Strasbourg, Lyon, Grenoble, Sophia Antipolis

•**A plateforme fully operational and open to users:**
•100% of the equipments have been deployed between 2011 & 2015

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Testbed abstractions

	object	service
	**resource**	Testbed ensures proper management of nodes, links, switches, ...
	**user**	Testbed guarantees the identity of its users
	slice	A distributed container in which ressources are shared : • sharing with VMs, in time, frequency, within flowspace, etc. The base for accountability
	**authority**	An entity responsible for a subset of services (resources, users, slices, etc.)

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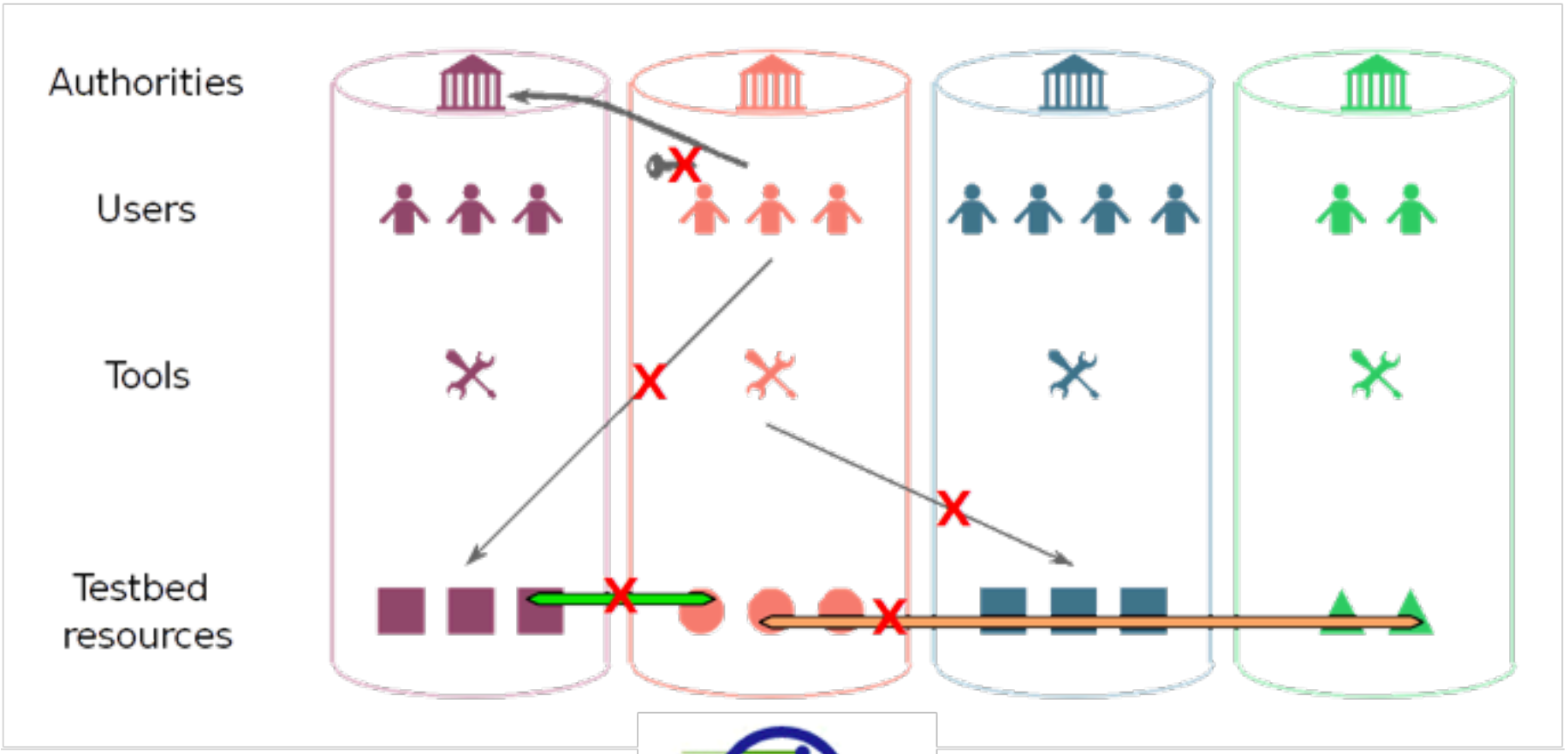
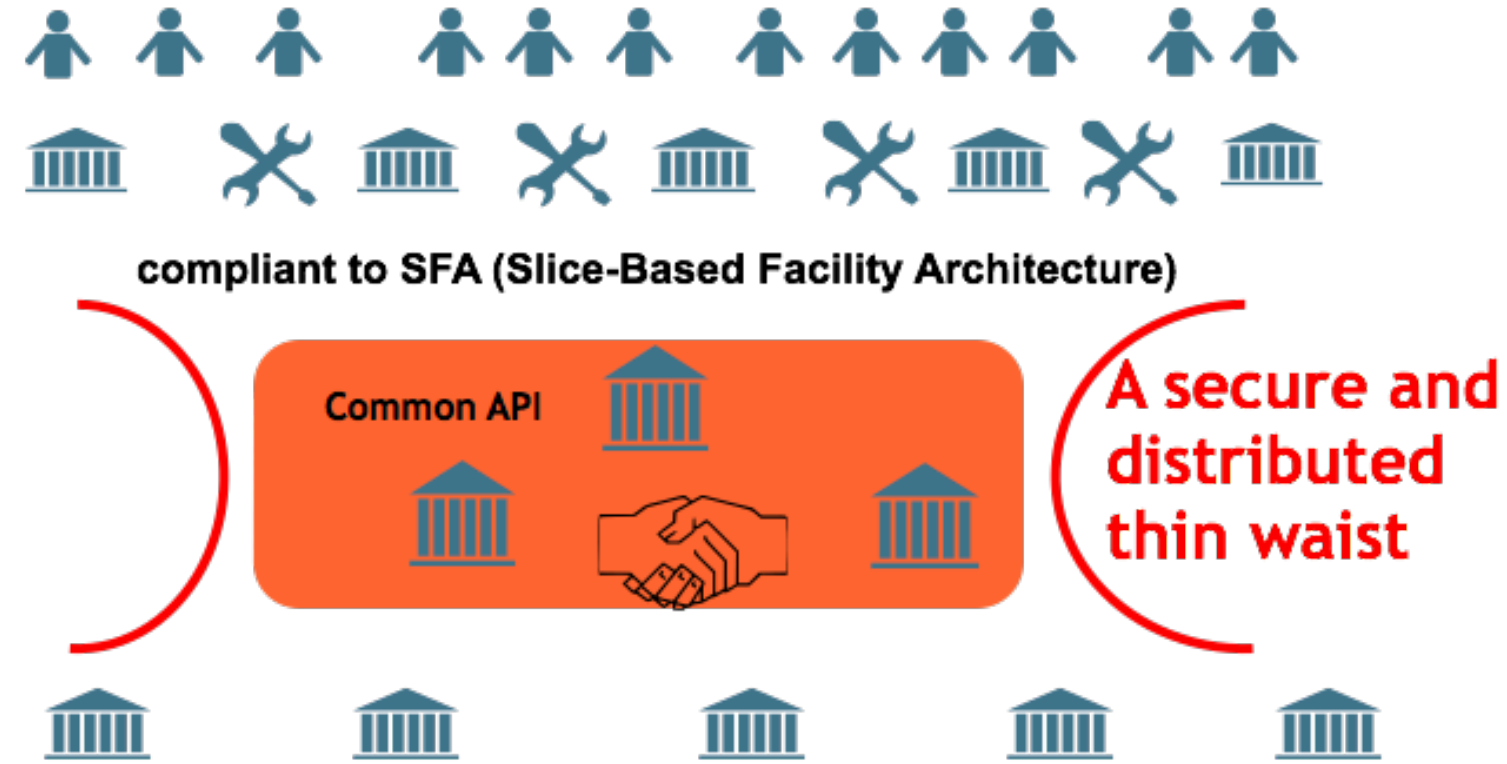
The issue with testbed isolation

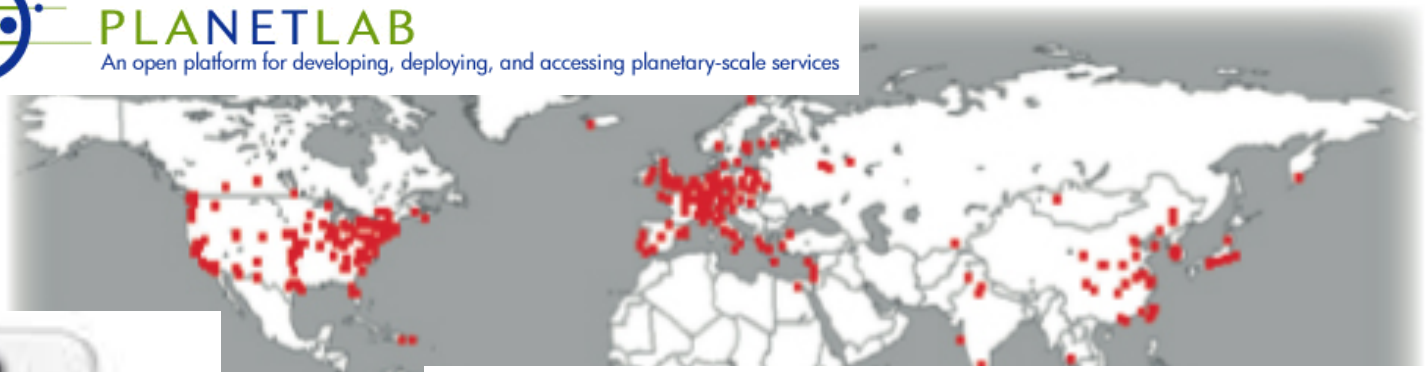


Federation


compliant to SFA (Slice-Based Facility Architecture)
Common API
A secure and distributed thin waist
IoT-lab
NITOS
Testbed resources

Building International Federation

PLANETLAB
An open platform for developing, deploying, and accessing planetary-scale services



PLANETLAB Europe
An open platform for developing, deploying, and accessing planetary-scale services

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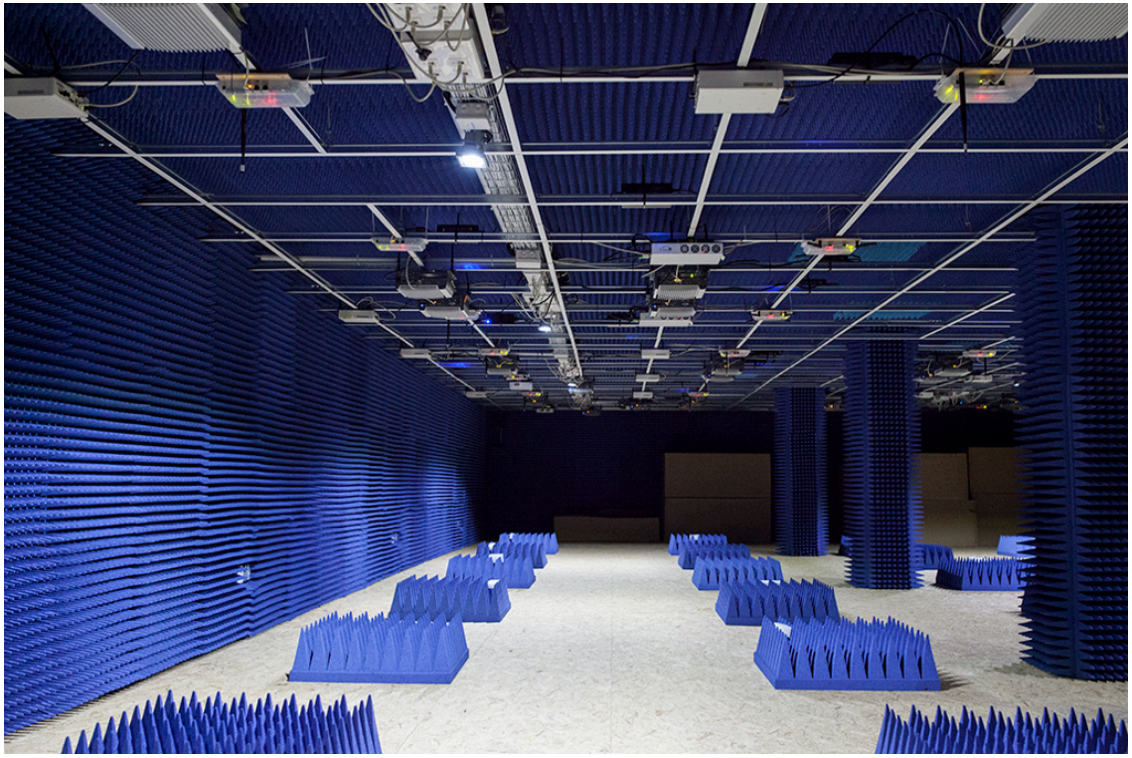
FIT R2Lab
Testbed Sophia-Antipolis

37 nodes in anechoic chamber

FIT CorteXlab's Shilded Anechoic Chamber



80 cognitive radio nodes (GNU Radio)

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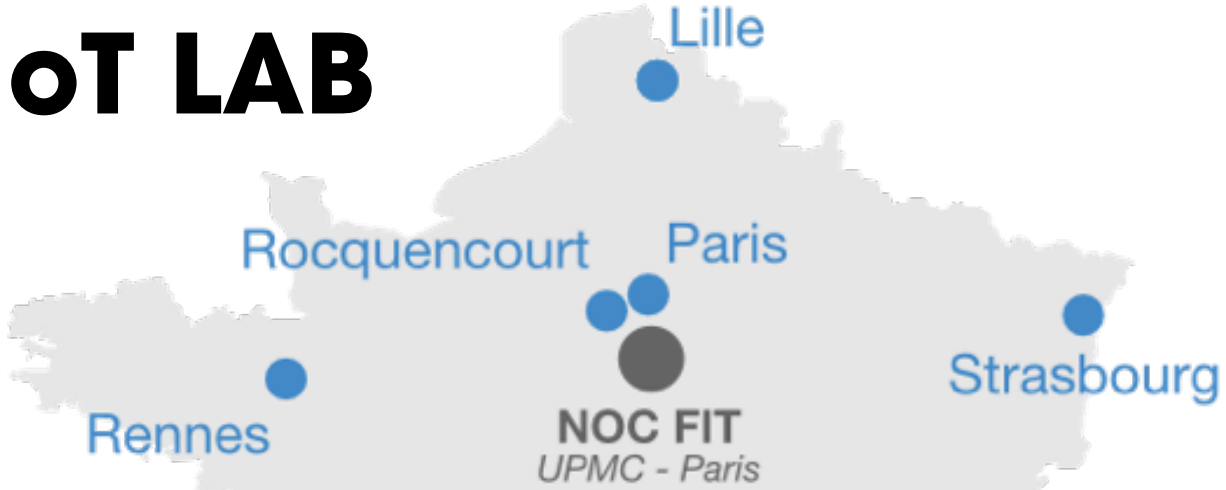
FIT IoT LAB



More than 2700+ wireless nodes

- IMS band
- IEEE 802.15.4

Low Power and Lossy Networks

- Total Remote Access
- Total Open Access
- Mobile Nodes/Robots

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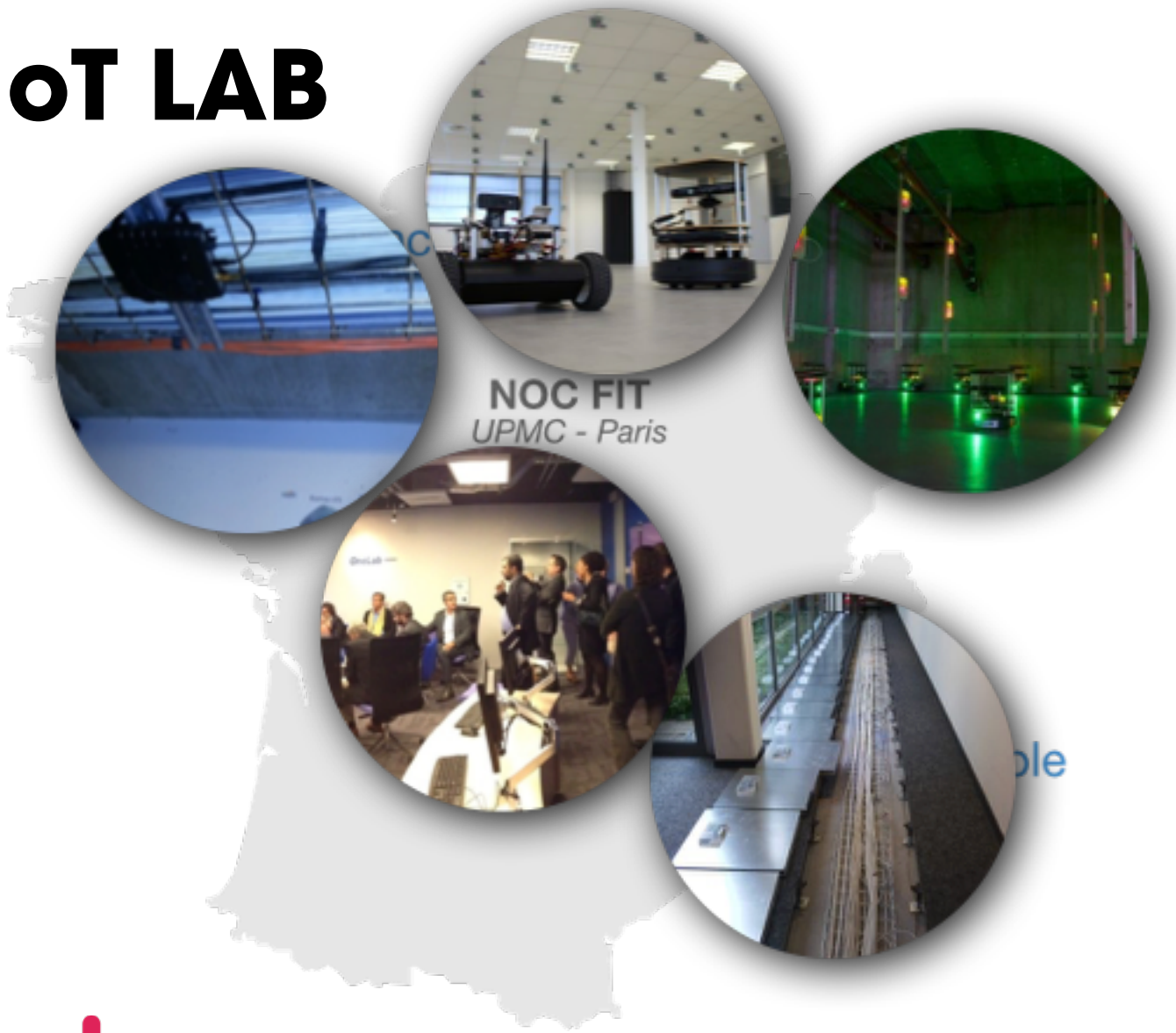
FIT IoT LAB



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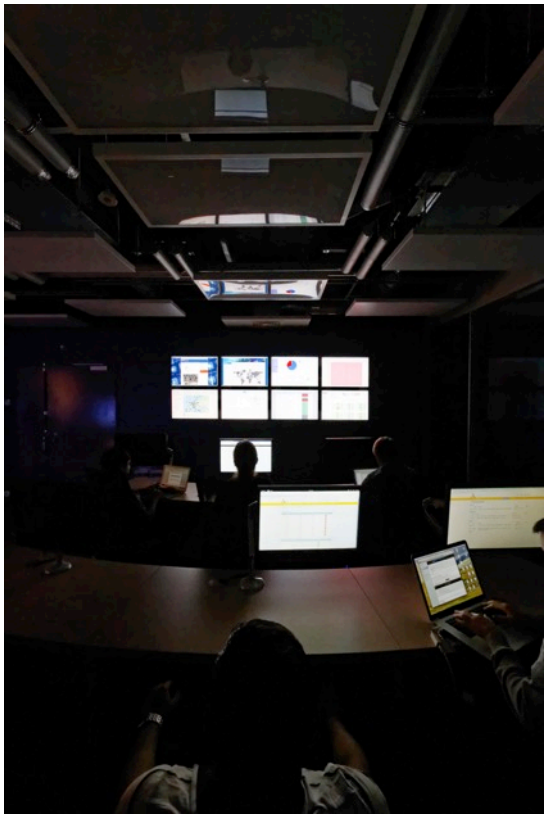
OneLab Network Operations Center



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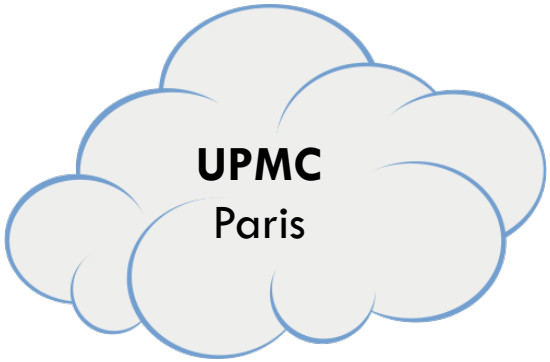
Inauguration R2Lab, 9 novembre 2016

FIT Cloud

•**FIT Cloud** : 2 plateformes



1 control node
4 compute nodes

4 control nodes
1 network node
1 storage node
11 compute nodes

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FIT Cloud

- **FIT Cloud** : Paris CloudLab
  nodes of CloudLab

UPMC
Paris

2 control nodes
HP Moonshot Chasis:
- 45 x HP m400 nodes (360 cores, 2,9 TB RAM)
- 2 OpenFlow HP 45XGc Switches

OneLab
FUTURE INTERNET TESTBEDS
to get an account

CloudLab
to control experiment

UTAH

7 x HP Moonshot Chasis:
- 315x HP m400 nodes
- 14x HP 45XGc Switches

Wisconsin

90x Cisco UCS SFF 220 M4,
10x Cisco UCS LFF 240 M4

- Bulk block storage,

Clemson

- Low density storage for MapReduce/Hadoop-like computing

- Generic VM nodes used to provision virtual machines

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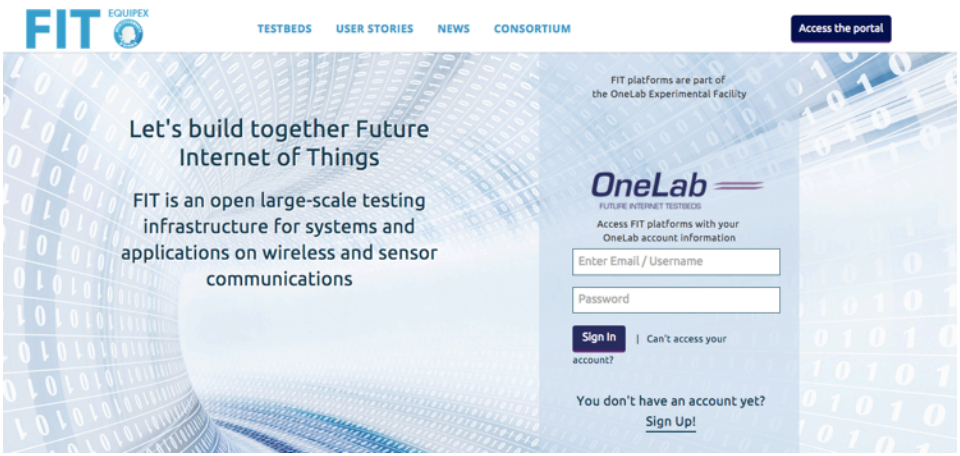
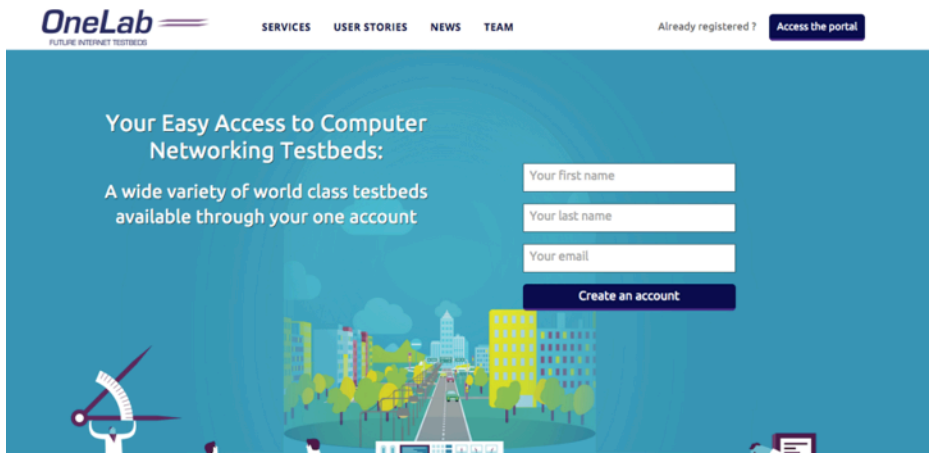
How to use it

- **Free and open to all**
- One main site : https://www.fit-equipex.fr/
- A unique portal : https://portal.onelab.eu
- Open & standart tools to ease theaccess





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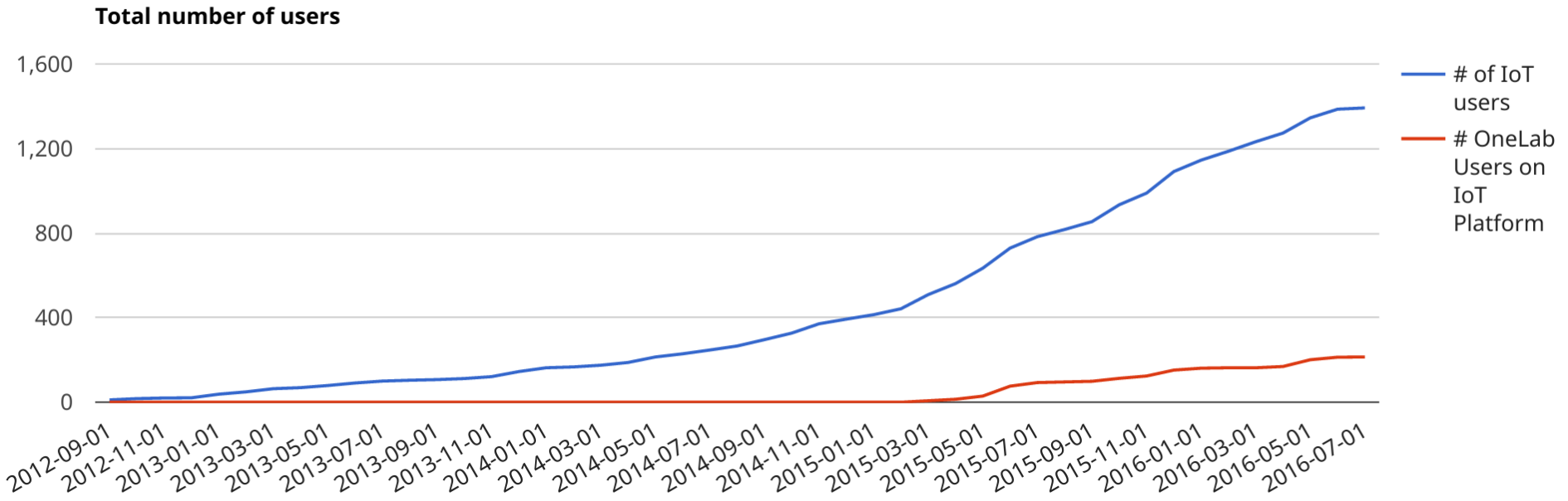
FIT user's monitoring



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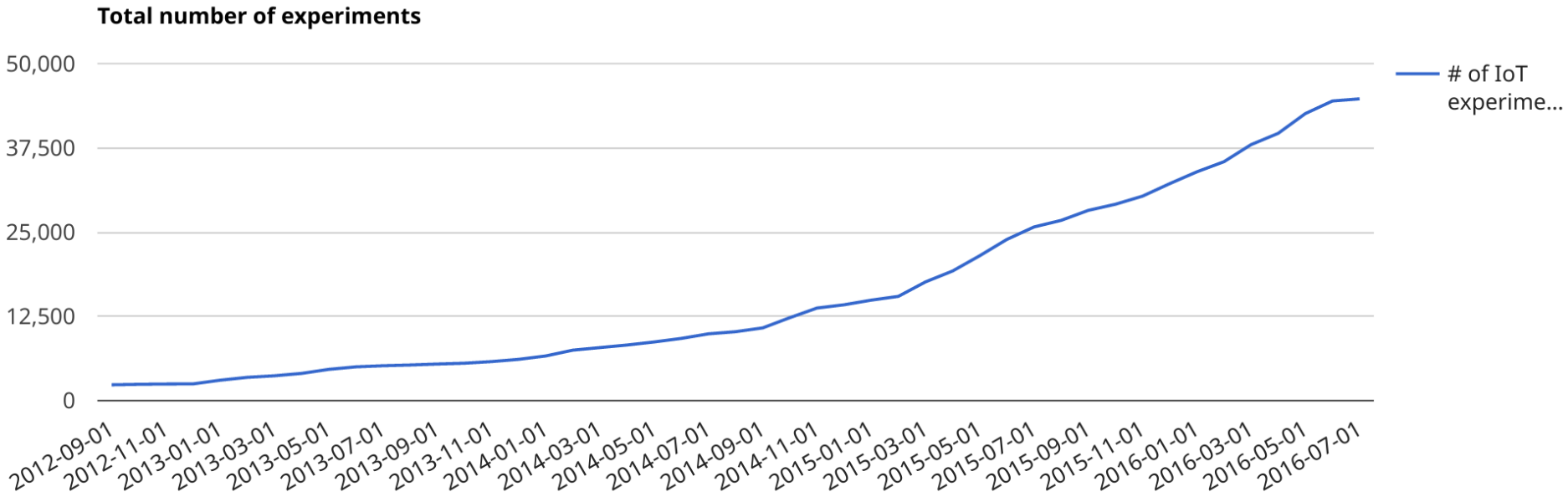
FIT Experiments monitoring



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Partners & projects

- **Privileged private partners**
  - Formal cooperation
    - HiKob (PME, partenariat + FUI)
    - Traxens (Startup, Cifre)
    - AlterWay / Thales / Zenika (FUI)
    - Orange Labs (Contrat & Cifre)
    - Pôles et IRT
  - Systematic/Systemx
    - Minalogic et IRT Nano, SCS
    - Railenium, CITC
  - European projects
    - (F-Interop, Armour, Embers, Fed4Fire, etc.)
    - Use FIT a a reference platform

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How to?

Some Use Cases of FIT (OneLAB) for Smart Cities and Industry 4.0 …

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New projects with a different flavor

- F-Interop (Conformance testing): http://www.f-interop.eu

- Armour (IoT security) http://www.armour-project.eu

- Smart city mobility ecosystem
  - http://embers.city

EMBERS

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Prototyping a Smart City Solution

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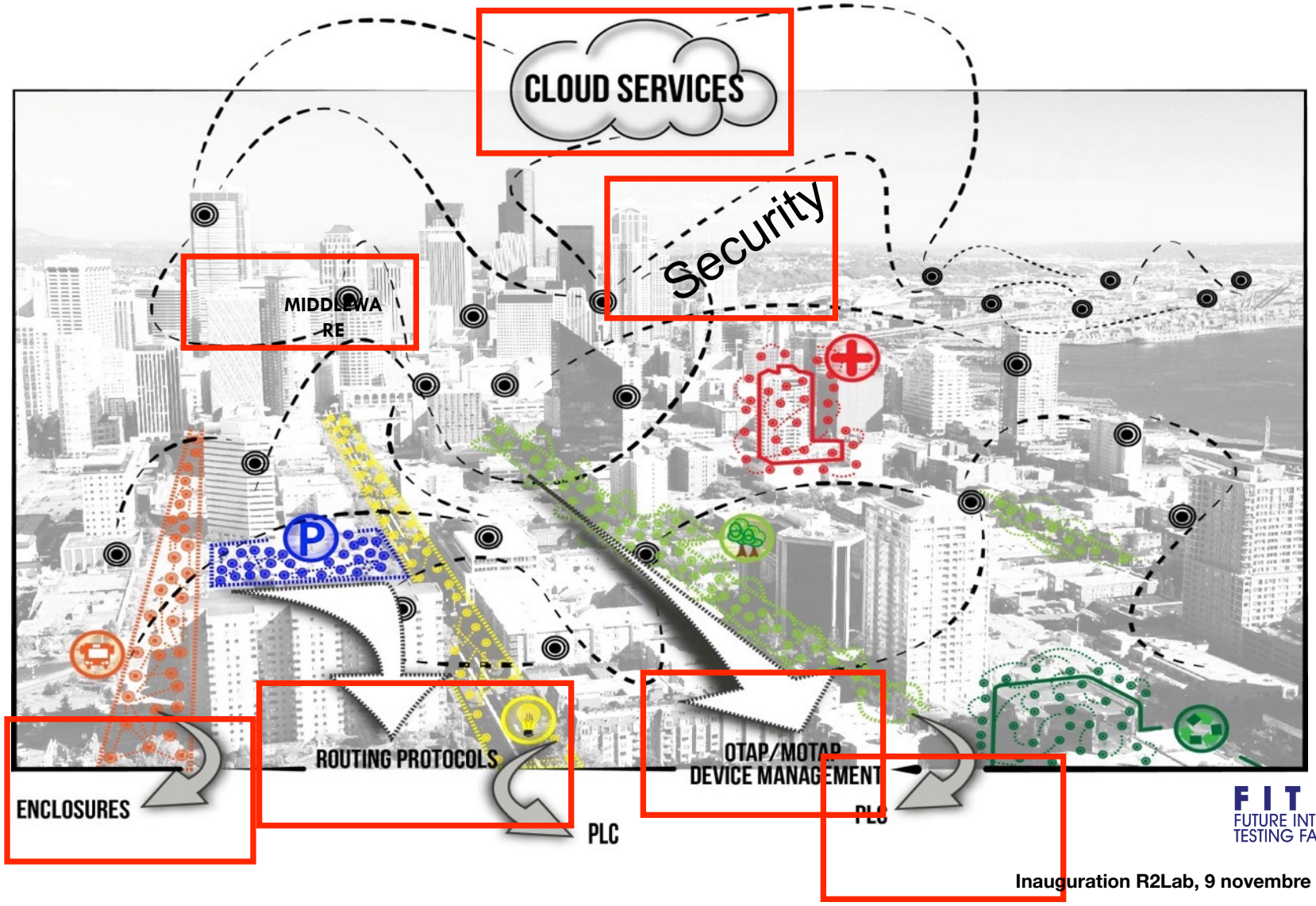
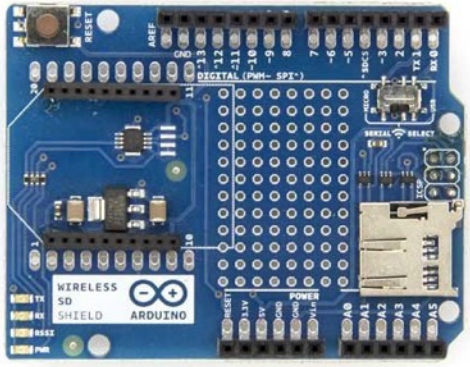
TILAS Architecture



Nodes from the UPEC Testbed

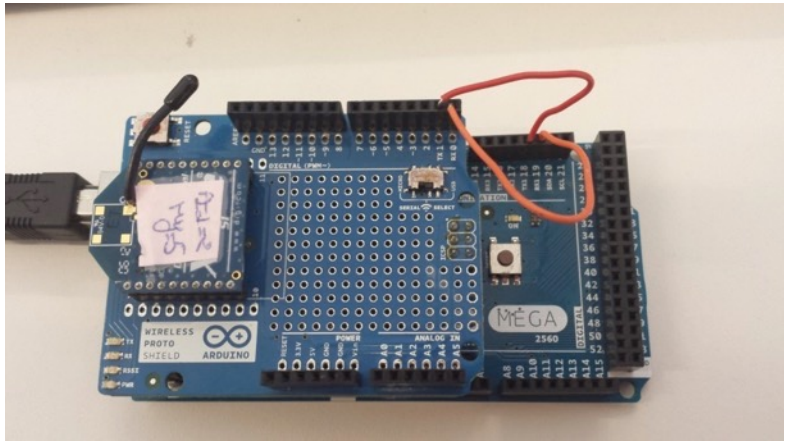
Arduino mega2560



Arduino Wireless shield

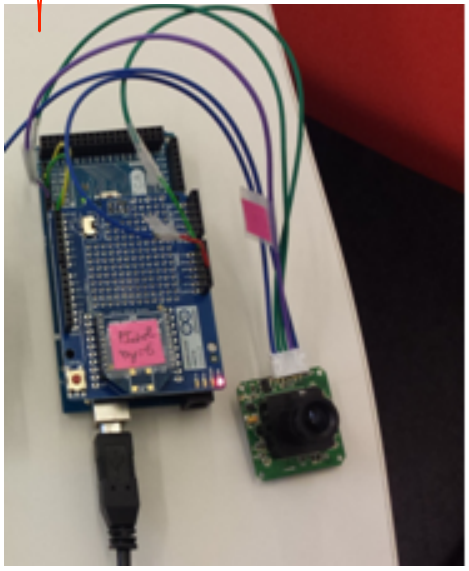
ESP8266

Serial Jpeg camera



TILAS end device

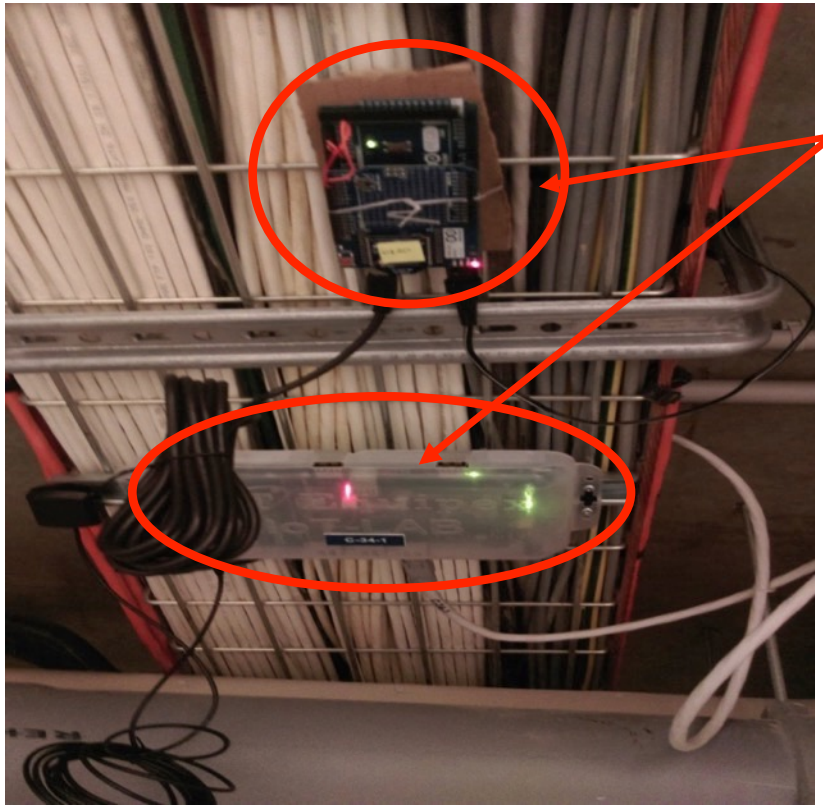
TILAS multimedia end device

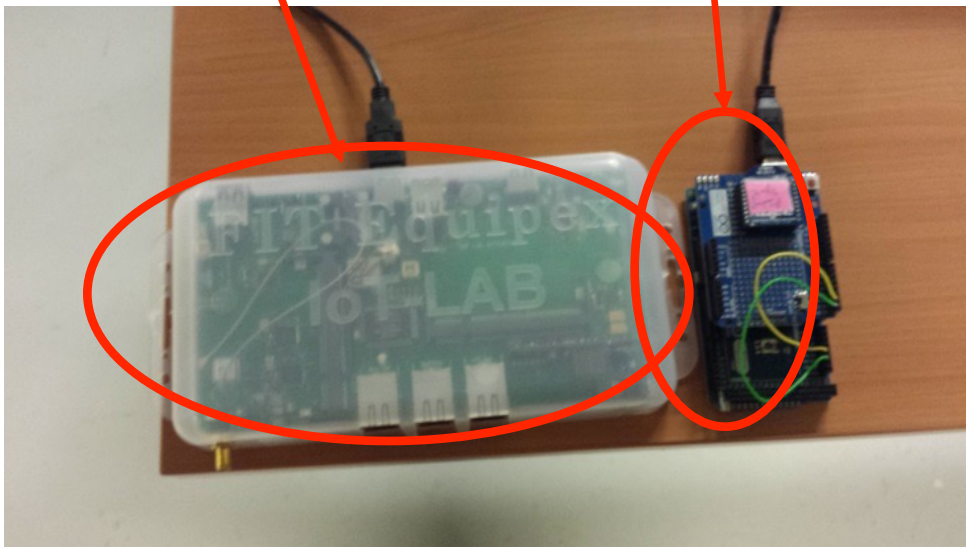


Integration (#1) of the TILAS UPEC Testbed at FIT Rocquencourt

FIT A8 node

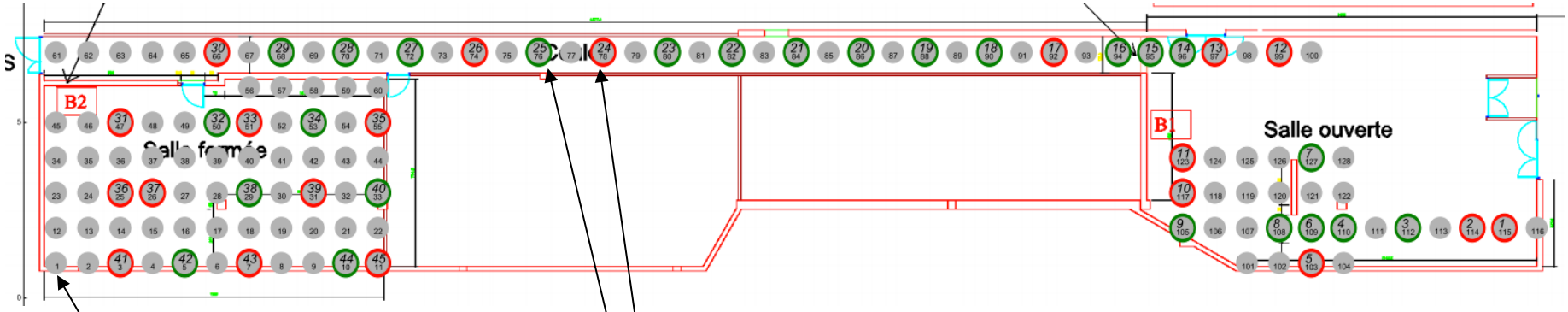
Arduino node





Integration (#1) of the TILAS UPEC Testbed at FIT Inria Paris Saclay

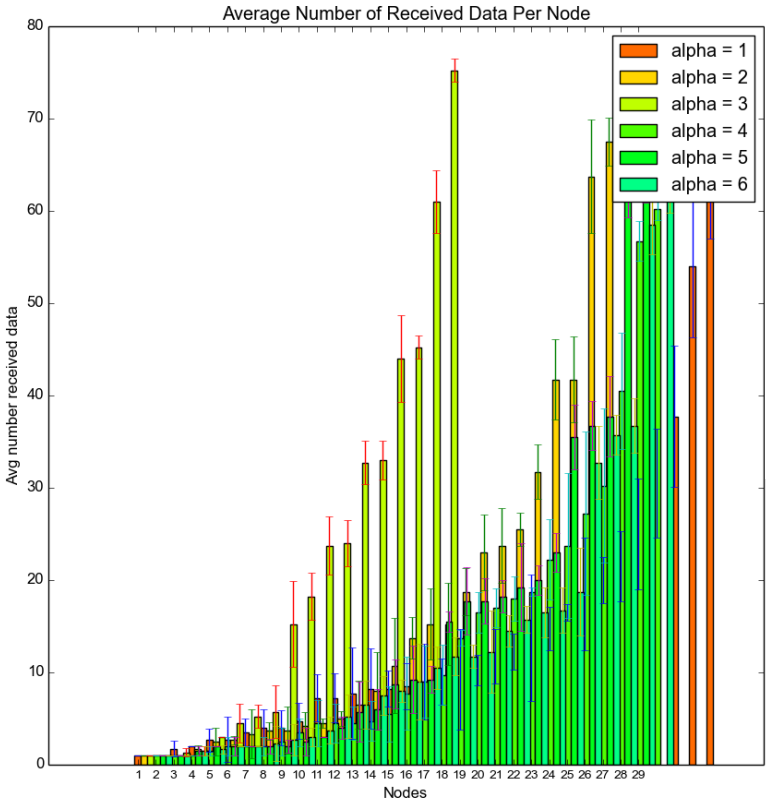
45 nodes from UPEC testbed attached to 45 of the FIT IoT-LAB Nodes in Rocquencourt testbed

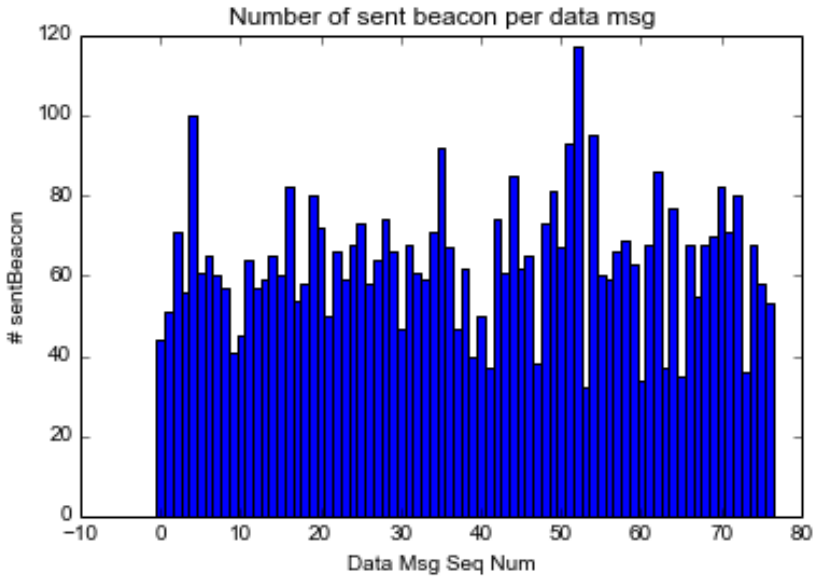


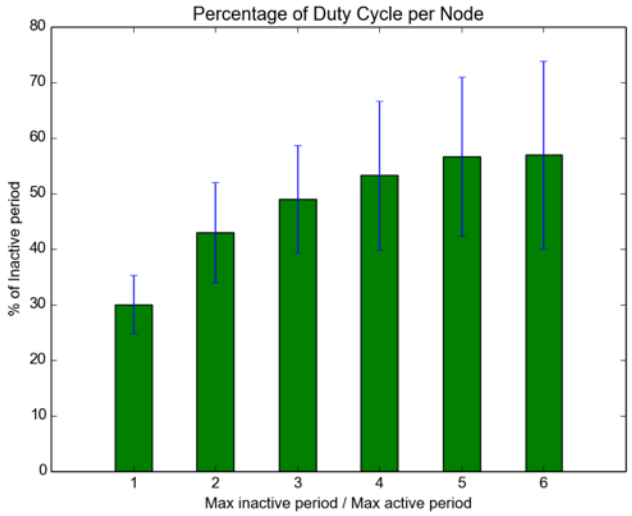
FIT Iot-LAB node (untouched)

FIT Iot-LAB nodes connected to UPEC Arduino nodes (green or red circles)

Example UPEC Odysse protocol analysis on FIT IoT-LAB







Internationalization

International access through several cooperations

FIT

OpenLab

(EU FP7)

FED4FIRE

(EU FP7)

eit Digital

FIRE

(EU FP7)

geni Exploring Networks of the Future

(NSF, USA)

fibre

(EU FP7 / Brazil)

SmartFIRE

(EU / Korea)

財團法人資訊工業策進會 INSTITUTE FOR INFORMATION INDUSTRY

(MoU Taiwan)

ICT

(MoU China)

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Future plans

- **FIT is now a french IR** (Infrastrcuture de Recherche):
http://www.enseignementsup-recherche.gouv.fr/pid25384/strategie-nationale-des-infrastructures-de-recherche.html

- **Provide services to the community**

- **Master Program / Virtual Lab**

- Moving forward
Joint action with Grid5000 to prepare a proposal for ESFRI/TGIR

- Support from all is welcome

- **Register and use it : https://fit-equipex.fr/**

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